lens (a lens for forming parallel light rays) as the lens 330 while using a condensing lens as the lens 332. By this arrangement, the linearly polarized light is parallelized by means of the collimate lens 330 before it is focused through the condensing lens 332. Therefore, the linearly polarized light can be readily focused at the input ends of the first and second optical fibers 306 and 308. In Fig. 9, the same elements as shown in Fig. 8 are indicated by the same reference numerals as used in Fig. 8, and overlapping explanation is omitted.

INDUSTRIAL APPLICABILITY

As has been described in detail above, in the current measuring apparatus according to the present invention, the number of components can be reduced, thus achieving a reduction in size of the current measuring apparatus. Further, the current measuring apparatus can be easily assembled, thereby achieving a reduction in cost.

CLAIMS

1. A current measuring apparatus comprising:

an optical fiber sensor extended or looped around a conductor through which a current to be measured flows,

linearly polarized light emitted from a light source and propagated through said optical fiber sensor having a plane of polarization rotated under a magnetic field generated by the current to be measured;

a photoelectric converter for converting into an electrical value an angle of rotation of the plane of polarization of the linearly polarized light after it exits said optical fiber sensor; and

a photocircuit disposed between said optical fiber sensor and said photoelectric converter,

said photocircuit including a birefringent member for separating the linearly polarized light into an ordinary ray and an extraordinary ray by birefringence and outputting the ordinary and extraordinary rays,

said current measuring apparatus further comprising:

a plurality of optical fibers for transmitting the ordinary ray from the birefringent member of the photocircuit to said photoelectric converter, while transmitting the extraordinary ray from the birefringent member of the photocircuit to said

photoelectric converter; and

a maintaining means adapted to maintain said plurality of optical fibers with a gap of a predetermined size being formed therebetween,

said plurality of optical fibers having one end and an opposite end, said one end of the plurality of optical fibers being disposed in the vicinity of said birefringent member, and said opposite end being connected to said photoelectric converter.

2. A current measuring apparatus according to claim 1, wherein a separation distance between the ordinary ray and the extraordinary ray in said birefringent member is matched to said predetermined size of the gap in the maintaining means.

3. A current measuring apparatus according to claim 1 or 2, wherein said photocircuit further comprises a lens system disposed between an end of said optical fiber sensor and said birefringent member, focal points of said lens system being formed at said end of the optical fiber sensor and said one end of the optical fibers.

4. A current measuring apparatus according to any one of claims 1 to 3, wherein said maintaining means comprises a gap maintaining member for maintaining said optical fibers parallel to each other with the gap of a predetermined size being formed therebetween.

5. A current measuring apparatus according to claim 4, wherein said optical fiber sensor has one end on

which the linearly polarized light is incident and an opposite end by which the incident linearly polarized light is reflected, the reflected linearly polarized light being adapted to exit the optical fiber sensor from said one end.

6. A current measuring apparatus according to claim 5, wherein said photoelectric circuit further comprises a Faraday element disposed between said one end of the optical fiber sensor and said birefringent member, said Faraday element being adapted to rotate the plane of polarization of the linearly polarized light through 22.5°.

7. A current measuring apparatus according to claim 6, wherein said plurality of optical fibers comprises:

a first optical fiber for transmitting the light from said light source to said birefringent member and transmitting the ordinary ray returned from said birefringent member to said photoelectric converter; and

a second optical fiber for transmitting the extraordinary ray returned from said birefringent member to said photoelectric converter.

8. A current measuring apparatus according to claim 7, wherein said lens system is disposed between said one end of the optical fiber sensor and said birefringent member, the focal points of said lens system being formed at an end-face core portion of said optical fiber sensor and an end-face core portion

of said first optical fiber.

9. A current measuring apparatus according to claim 8, wherein said gap maintaining member comprises a two-core ferrule for maintaining said first optical fiber and said second optical fiber parallel to each other with the gap of a predetermined size being formed therebetween.

10. A current measuring apparatus according to claim 6, wherein said photocircuit further comprises:

a second birefringent member having the linearly polarized light from said optical fiber sensor directed thereto through said Faraday element and being adapted to separate the linearly polarized light into an ordinary ray and an extraordinary ray that are orthogonal to each other; and

a second Faraday element for rotating respective planes of polarization of the ordinary ray and the extraordinary ray from said second birefringent member through 45°,

said birefringent member being arranged such that the ordinary ray with the 45°-rotated plane of polarization is transmitted therethrough on a light axis, while the extraordinary ray with the 45°-rotated plane of polarization is refracted by birefringence so that the ordinary ray and the extraordinary ray exit said birefringent member with an increased separation distance,

said birefringent member being arranged such

that, out of the light emitted from the light source, linearly polarized light incident along a plane orthogonal to a plane containing a crystal axis of said birefringent member and the light axis is transmitted therethrough on the light axis, and outputted to said second Faraday element.

11. A current measuring apparatus according to claim 10, wherein said plurality of optical fibers comprises:

a polarization preserving optical fiber for directing said random light from the light source to said birefringent member;

a first optical fiber for transmitting the ordinary ray emerging from said birefringent member to said photoelectric converter; and

a second optical fiber for transmitting the extraordinary ray emerging from said birefringent member to said photoelectric converter.

12. A current measuring apparatus according to claim 11, wherein

said photocircuit further comprises a lens system disposed between said one end of the optical fiber sensor and said second birefringent member, focal points of said lens system being formed at an end-face core portion of said optical fiber sensor and an end-face core portion of said polarization preserving optical fiber.

13. A current measuring apparatus according to claim

12, wherein said gap maintaining member comprises a three-core ferrule for maintaining said polarization preserving optical fiber, said first optical fiber and said second optical fiber parallel to each other with the gap of a predetermined size being formed therebetween.

14. A current measuring apparatus according to any one of claims 5 to 13, wherein said optical fiber sensor is a reflection type sensor.

15. A current measuring apparatus according to any one of claims 1 to 4, wherein said optical fiber sensor has one end on which the linearly polarized light is incident and an opposite end from which the incident linearly polarized light is outputted.

16. A current measuring apparatus according to claim 15, wherein said photocircuit further comprises a polarizer for transmitting only linearly polarized light out of random light emitted from the light source,

said one end of the optical fiber sensor being disposed in the vicinity of said polarizer,

said opposite end of the optical fiber sensor being disposed in contact with said birefringent member,

a transmission axis of said polarizer and a crystal axis of said birefringent member being angularly displaced at 45° relative to each other, to thereby enable said birefringent member to separate

the linearly polarized light emitted from said optical fiber sensor into the ordinary ray and the extraordinary ray that are orthogonal to each other.

17. A current measuring apparatus according to claim 16, wherein said plurality of optical fibers comprises:

a first optical fiber for transmitting the ordinary ray emerging from said birefringent member to said photoelectric converter; and

a second optical fiber for transmitting the extraordinary ray emerging from said birefringent member to said photoelectric converter.

18. A current measuring apparatus according to claim 17, wherein said lens system is disposed between said opposite end of the optical fiber sensor and said birefringent member, the focal points of said lens system being formed at an end-face core portion of said opposite end of the optical fiber sensor and an end-face core portion of said first optical fiber.

19. A current measuring apparatus according to claim 18, wherein said gap maintaining member comprises a two-core ferrule for maintaining said first optical fiber and said second optical fiber parallel to each other with the gap of a predetermined size being formed therebetween.

20. A current measuring apparatus according to any one of claims 15 to 19, wherein said optical fiber sensor is a transmission type sensor.

21. A current measuring apparatus according to claim 1, wherein:

said photoelectric converter comprises a first photoelectric converter element and a second photoelectric converter element; and

said plurality of optical fibers comprises:

a first optical fiber for transmitting the ordinary ray from the birefringent member to said first photoelectric converter element; and

a second optical fiber for transmitting the extraordinary ray from the birefringent member to said second photoelectric converter element,

an average value of an index of modulation being calculated with respect to each of two electrical signals obtained by said first and second photoelectric converter elements.

22. A current measuring apparatus comprising:

an optical fiber sensor extended or looped around a conductor through which a current to be measured flows, said optical fiber sensor being adapted to detect an angle of Faraday rotation, under a magnetic field of the current to be measured, of linearly polarized light emitted from a light source and propagated through said optical fiber sensor;

a photoelectric converter for converting the angle of Faraday rotation detected by said optical fiber sensor into an electrical value; and

a photocircuit disposed between said optical

fiber sensor and said photoelectric converter,

said photocircuit including:

a Faraday element disposed in the vicinity of an input end of said optical fiber sensor and adapted to rotate a plane of polarization of the linearly polarized light through a predetermined angle; and

a light-transmitting birefringent member disposed between said Faraday element and said photoelectric converter and adapted to separate the light emitted from said optical fiber sensor into an ordinary ray and an extraordinary ray that are orthogonal to each other,

said current measuring apparatus further comprising:

a first optical fiber for directing the linearly polarized light to said birefringent member, while transmitting the ordinary ray emerging from the birefringent member to said photoelectric converter; and

a second optical fiber for transmitting the extraordinary ray emerging from the birefringent member to said photoelectric converter,

said photocircuit further including a lens system disposed between said input end of the optical fiber sensor and said birefringent member, focal points of said lens system being formed at an end-face core portion of said optical fiber sensor and an end-face core portion of said first optical fiber.

23. A current measuring apparatus according to claim 22, wherein said lens system is disposed between said birefringent member and said Faraday element.

24. A current measuring apparatus according to claim 22, wherein said birefringent member comprises a plane-parallel plate made of a material selected from the group consisting of rutile, yttrium orthovanadate, lithium niobate and calcite.

25. A current measuring apparatus according to any one of claims 22 to 24, wherein:

said first and second optical fibers are maintained parallel to each other with a gap of a predetermined size being formed therebetween, by means of a gap maintaining member, such as a two-core ferrule; and

said predetermined size of the gap between the first and second optical fibers is matched to a separation distance between the ordinary ray and the extraordinary ray, the separation distance being determined in relation to a thickness of, and a material for said birefringent member formed by the plane-parallel plate.

26. A current measuring apparatus according to any one of claims 22 to 25, wherein said predetermined angle is approximate to 22.5°.